

Claims

What is claimed is:

1. A fuel burner for a gas turbine engine disposed about a central axis, said fuel burner comprising:

a first cylinder having a first end portion and a second end portion, said first cylinder having first array of orifices disposed between said first end portion and said second end portion, said first cylinder being disposed about said central axis; and

a second cylinder having a first end portion and a second end portion, said second cylinder having a second array of orifices disposed between said first end portion and said second end portion, said second cylinder being coaxial with said first cylinder,

said first cylinder being disposed between said second cylinder and said central axis,

said first array of orifices being offset from said second array of orifices.

2. The fuel burner of claim 1 wherein said first array of orifices and said second array of orifices are offset axially about said central axis.

3. The fuel burner of claim 1 wherein said first array of orifices and said second array of orifices are offset tangentially about said central axis.

4. The fuel burner of claim 1 wherein said first array of orifices have a smaller diameter than said second array of orifices.

5. The fuel burner of claim 1 wherein said first array of orifices have diameters varying as a function of an axial position along said central axis.

6. The fuel burner of claim 5 wherein said function increases said diameters as said axial position moves along said central axis.

7. The fuel burner of claim 1 wherein a gap between said first cylinder and said second cylinder changes along said central axis.

8. The fuel burner of claim 1 including a mixing conduit having an entrance portion, said mixing conduit being connected with said first end portion of said first cylinder distal from said entrance portion.

9. The fuel burner of claim 8 including a fuel supply line positioned proximate said entrance portion of said mixing conduit.

10. The fuel burner of claim 9 including a plurality of vortex generator tabs intermediate said fuel supply tube and said first end portion of said first cylinder.

11. The fuel burner of claim 9 including a second fuel supply line being positioned adjacent said first end portion of said second cylinder, said second cylinder being disposed between said second fuel supply line and said first cylinder.

12. The fuel burner of claim 1 including a circulating device positioned in the first cylinder to circulate the mixture of fuel and air.

13. A method of burning a fuel in a gas turbine engine,
comprising:
supplying a mixture of fuel and air to a first cylinder;

flowing said mixture of fuel and air through a first array of orifices in said first cylinder;

reducing a pressure of said mixture of fuel and air;

impinging a second cylinder with said mixture of fuel and air;

transferring heat from said second cylinder to said mixture of fuel and air during said impinging;

mixing further said mixture of fuel and air after said transferring;

passing said mixture of fuel and air through a second array of orifices in said second cylinder; and

igniting said mixture of fuel and air.

14. The method of burning fuel of claim 13 wherein said further mixing includes increasing turbulent mixing in a gap between said first cylinder and said second cylinder.

15. The method of burning fuel of claim 13 wherein said mixture of fuel and air impinging said second cylinder substantially perpendicular.

16. The method of burning fuel of claim 13 wherein said igniting step is supplying a diffusion flame to said mixture of fuel and air.

17. The method of burning fuel of claim 16 wherein a majority of a pressure reduction occurs through the first array of orifices.

18. A combustion system for a gas turbine engine, said combustion system comprising:

a combustor liner;

a first cylinder positioned inside the combustor liner;

a second cylinder positioned between said first cylinder and said combustion liner, said second cylinder being coaxial with said first cylinder;
a first array of orifices disposed through said first cylinder;
a second array of orifices disposed through said second cylinder, said second array of orifices being substantially offset from said first array of orifices;
a mixing conduit fluidly connecting with said first cylinder; and
a fuel supply conduit positioned proximate an entrance portion of said mixing conduit.

19. The combustion system of claim 18 including a fluid mixing means for mixing the fuel and air in said mixing conduit.

20. The combustion system of claim 19 wherein said mixing means includes vortex generator tabs.

21. The combustion system of claim 18 including a slot adjacent a first end portion of said second cylinder, said slot containing a plurality of fuel supply orifices, said pilot fuel supply orifices being connected with a fuel gallery.

22. The combustion system of claim 18 including a circulating device positioned proximate a second end portion of said second cylinder.

23. A method of cooling a fuel burner for a gas turbine engine, comprising:
supplying a mixture of fuel and air to a first cylinder;
circulating said mixture of fuel and air with a circulating device in said first cylinder;

flowing said mixture of fuel and air through at least one orifice of said circulating device;

flowing said mixture of fuel and air through a first array of orifices in said first cylinder;

impinging a second cylinder with said mixture of fuel and air; and

transferring heat from said second cylinder to said mixture of fuel and air during said impinging.

24. The method claim 23, further including mixing further said mixture of fuel and air in gap between said first cylinder and said second cylinder.